EECS 114 HW3

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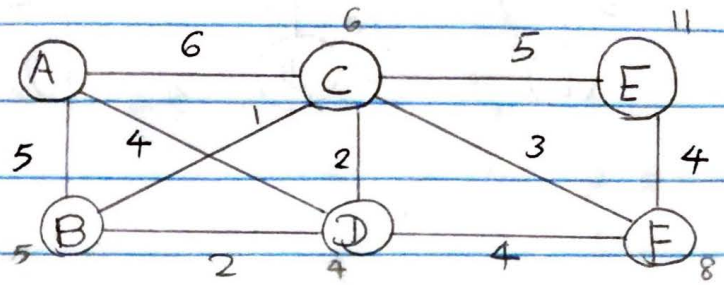
A. Graphs

1.



Vertex	Shortest distance from A	Previous Vertex
A	0	
B	5	A
C	6	A
D	4	A
E	11	C
F	8	D

visited vertex = [A, D, C, D, E, F]

A → B = 5

A → C = 6

A → D = 4

Dijkstra's algorithm

A → C → E = 11

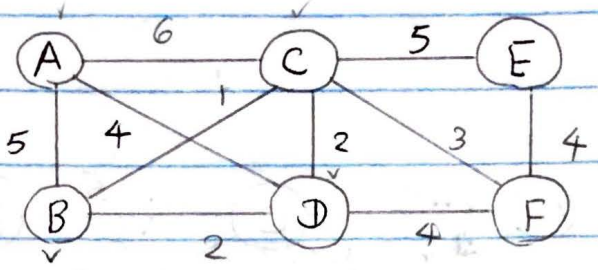
A → D → F = 8

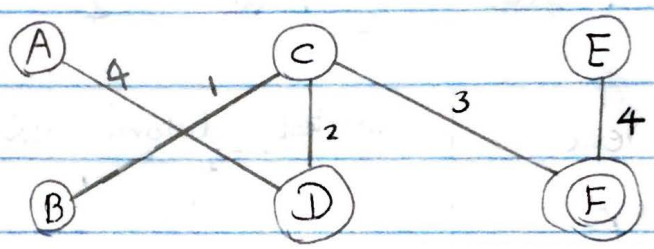
We always choose the shortest path to reach the vertex.

For example: A → C → F = 9 > A → D → F = 8

So, we choose A → D → F = 8

2.





~~A → B = 5~~

(B) → C = 1

C → D = 2

C → F = 3

~~C → B = 5~~

F → E = 4

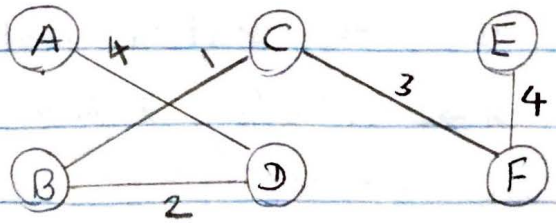
D → A = 4

Prims doesn't specify the starting node. It connects all the node with possible minimum cost. Then, it gives the minimum ~~Spaning~~ spanning tree.

Minimum spanning tree ~~= 5 + 1 + 2 + 3 + 5 = 16~~

= 4 + 1 + 2 + 3 + 4 = 14

3. The minimum spanning tree is not unique. We can build another different tree with same cost.



A → D = 4

D → B = 2

B → C = 1

C → F = 3

F → E = 4

MST = 4 + 2 + 1 + 3 + 4 = 14

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A 3.(a)

	Dijkstra's SPT	Prim's MST	Another MST
A → B	5	7	6
A → C	6	6	7
A → D	4	4	4
A → E	8	13	14
A → F	11	9	10
Total	34	39	41

$$d_{SPT}^{avg} = 34/5 = 6.8$$

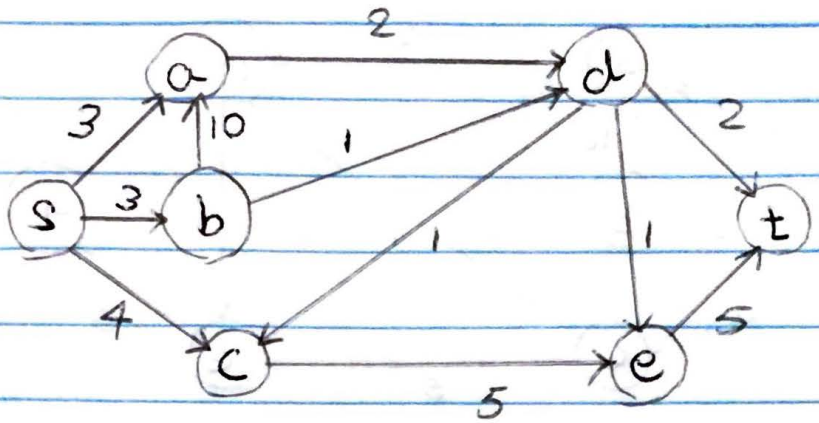
(b) $$d_{MST1}^{avg} = 39/5 = 7.8$$

$$d_{MST2}^{avg} = 41/5 = 8.2$$

$d_{SPT}^{avg} < d_{MST}^{avg}$ because SPT is defind to find the shortest path from the root to other nodes.

For graph G, the average distance using SPT is smaller that using of any possible MSTs.

B. 1.



s	a	b	c	d	e	t
0	∞	∞	∞	∞	∞	∞
	3	3	4			2
				4	5	5

Node	Next hop	Distance to t
s	b	6
a	d	4
b	d	3
c	e	10
d	t	2
e	t	5

$s \to b \to d \to t = 6 < s \to a \to d \to t = 7$

$\therefore s \to b \to d \to t = 6$ is choosen.

$a \to d \to t = 4$

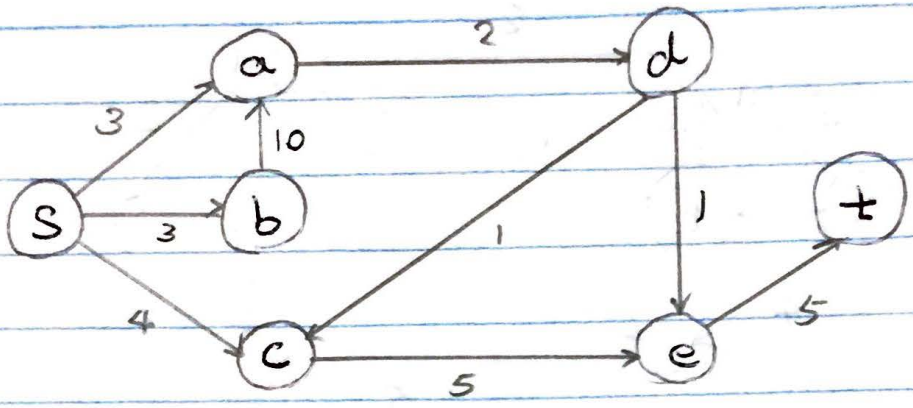
$b \to d \to t = 3$

$c \to e \to t = 10$

$d \to t = 2$

$e \to t = 5$

2.



Node	Next hop	distance t
S	a	11
a	d	8
b	a	18
c	e	10
d	e	6
e	t	5

$S \rightarrow a \rightarrow d \rightarrow e \rightarrow t = 11$

$a \rightarrow d \rightarrow e \rightarrow t = 8$

$b \rightarrow a \rightarrow d \rightarrow e \rightarrow t = 18$

$c \rightarrow e \rightarrow t = 10$

$d \rightarrow e \rightarrow t = 6$

$e \rightarrow t = 5$